PLANT PROTECTION BULLETIN

A Publication of the
WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

VOL. II, No. 2 NOVEMBER 1953

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME, ITALY

FAO PLANT PROTECTION BULLETIN

is issued as a medium for the dissemination of information received by the World Reporting Service on Plant Diseases and Pests, established in accordance with the provisions of the International Plant Protection Convention, 1951. It publishes reports on the occurrence, outbreak and control of pests and diseases of plants and plant products of economic significance and related topics, with special reference to current information. No responsibility is assumed by FAO for opinions and viewpoints expressed in the Bulletin.

Manuscripts for publication, or correspondence regarding the World Reporting Service, should be addressed to Dr. Lee Ling, Plant Production Branch, Agriculture Division, FAO, Viale delle Terme di Caracalla, Rome, Italy; subscriptions and other business correspondence to Documents Sales Service, FAO, Viale delle Terme di Caracalla, Rome, Italy.

The Bulletin is issued monthly in English, French, and Spanish, twelve numbers constituting a volume. Subscription rates are $ 3.00 or 15 s. per annum, single numbers are priced at $ 0.30 or 1s. 6d. The citation is FAO Plant Protection Bulletin, or, in abbreviation, FAO Plant Prot. Bull.

FAO Plant Protection Bulletin

VOL. II, No. 2 A Publication of the NOVEMBER 1953

World Reporting Service on Plant Diseases and Pests

Virus Diseases of Plants in Ceylon

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VIRUS disease investigations have been initiated by the Department of Agriculture of Ceylon as part of a long-range program designed to encourage greater food production through control of plant diseases and to protect the basic estate industries of tea and cacao, especially the latter, since disease symptoms suggestive of virus origin have been known for a long time in cacao.

Cacao

The recent experimental proof of the existence of a virus disease of cacao (*Theobroma cacao*) in Ceylon, has attracted attention owing to the serious effect of the virus disease, swollen shoot, upon cacao production in the Gold Coast. However, cacao growers of Ceylon have no reason to be greatly alarmed as no die-back or other evidence of conspicuous injury that can be attributed to virus disease has been found. The symptoms fit closely those described by Posnette [1] of an attenuated form of "swollen shoot." No swellings of any kind have been found on the twigs or branches of the trees, although they bear the characteristic foliage symptoms of swollen shoot. The foliage symptoms, the vein-clearing and vein-banding (Fig. 1, A), are in no respect different from those described in relation to swollen shoot. The disease has been transmitted to seedlings by grafting and by mealybugs. Two species of mealybug, tentatively determined as *Pseudococcus lilacinus* and *P. citri*, were established recently as the vectors by Dr. W. Carter of FAO and Dr. H. E. Fernando of the Ceylon Department of Agriculture [2].

The disease is widely distributed. No plantation carrying trees of twenty years or over has been found entirely free from the disease. However, plantations of young trees under ten years are usually free. A general relationship between the percentage of infected trees and the density of the mealybug populations suggests that the mealybugs are the principal vectors. An area where a large percentage of the trees is infected is usually surrounded by areas where the infection gradually decreases away from the center. This distribution pattern, together with evidence that any absence of trees blocks the spread of the disease, are other factors suggesting mealybug as the principal vector.

Legumes

Two virus diseases of dhal or pigeon pea (*Cajanus cajan*) have been established recently as distinct and sap-transmissible. One has been named "yellow mosaic" and the other "pale mosaic." Yellow mosaic is characterized by a bright yellow blotchy

[1] Posnette, A. F. "Virus diseases of cacao in West Africa. I. Cacao viruses 1A, 1B, 1C, and 1D." *Ann. Appl. Biol.* 34: 388-402. 1947.

[2] Unpublished data.

foliage mottle which makes the diseased plants very conspicuous, but at present the disease does not appear to be greatly affecting crop yields. The number of diseased plants in the stands at the time of seed maturity rarely exceeded 10 percent. The distribution appears to be confined to the dry-farming areas of the north central dry belt.

The other disease, pale mosaic, characterized by vein-banding followed by a light green mottle, has been found only in the wet zone in the vicinity of Peradeniya. Unlike yellow mosaic, pale mosaic spreads rapidly. In plots where only a few infected seedlings were found early in the season, all the plants were infected when they had reached the flowering stage. The appearance of a very small percentage of infected seedlings in most plantings suggests that the disease is seed transmissible, but supporting experimental evidence is not available. In addition to the distinctiveness of the symptoms this disease can be distinguished from yellow mosaic by sap transfers to princess bean (*Psophocarpus tetragonolobus*). Inoculations with pale mosaic had no effect within twenty days but inoculations with yellow mosaic induced conspicuous vein-banding in the newly formed foliage in 10 to 15 days, followed by a yellowish mottle.

A mosaic disease of *Crotolaria striata* and *C. hirsuta* is common in the wet zone and is sap-transmissible. The disease is characterized by vein-clearing followed by a conspicuous light green mottle. The virus causing this disease is distinct from those which cause yellow mosaic and pale mosaic of dhal as the *Crotolaria* virus is readily transferable by sap to cowpea variety V4, upon which it induces a mosaic type of mottle. Neither of the dhal viruses induces symptoms when transferred to the same variety of cowpea. The *Crotolaria* virus is also sap-transferable to princess beans, where it causes conspicuous vein-banding symptoms that closely resemble those induced by yellow mosaic of dhal, except that the mottle which follows is not so yellow.

Mosaic diseases of lima bean (*Phaseolus lunatus*), green gram (*P. mungo*) and a leguminous weed (*P. lathyroides*) have been found in close association with yellow mosaic of dhal in the north central dry belt and are consequently suspected of being caused by the same virus. The disease of lima bean was more virulent and widespread than those of the other *Phaseolus* species.

A vein-banding virus disease of dadap (*Erythrina lithosperma*), a popular shade tree over cacao, is of some interest (Fig. 1, B). The trees are invariably infected when the cacao trees below them are heavily infected with the cacao vein-banding virus, whilst vein-banding is comparatively rare on dadap over cacao that is practically free from vein-banding symptoms. The recent discovery that mealybug colonizes on dadap is also of significance. Only a fraction of the leaves on infected dadap trees bear the vein-banding symptoms, and the disease does not appear to affect the vitality of the trees. The disease is not sap-transmissible and mealybug transmission trials have not been carried out.

Sweet Potato

A mosaic disease of sweet potato (*Ipomoea batatas*) is quite common wherever the crop is grown and may partly account for the poor yields obtained with many varieties and for the unpopularity of the crop in Ceylon. The disease is characterized by a mosaic type of mottle with little or no leaf distortion (Fig. 1, C). In the trial plots of Peradeniya the varieties Golden Yellow and White Maltese were severely infected. The disease was readily transmitted to apparently healthy plants of the same variety by inarching the stems of rooted cuttings.

Hibiscus

Yellow vein mosaic of okra or bandakka (*Hibiscus esculentus*) is common and exceedingly disastrous in the Matale district, the northern portion of the south central wet belt. Since the disease appeared a few years ago the yields have declined over 50 percent. The disease is transmitted by a white fly and a field study of its distribution early in the growing season suggested that the disease is harbored by weeds on the uncultivated land of the area. Although Capoor and Varma [3] found that in India the host range of

[3] Capoor, S. P. and P. M. Varma. "Yellow vein-mosaic of *Hibiscus esculentus* L." *Indian Jour. Agr. Sci.* 20: 217–230. 1950.

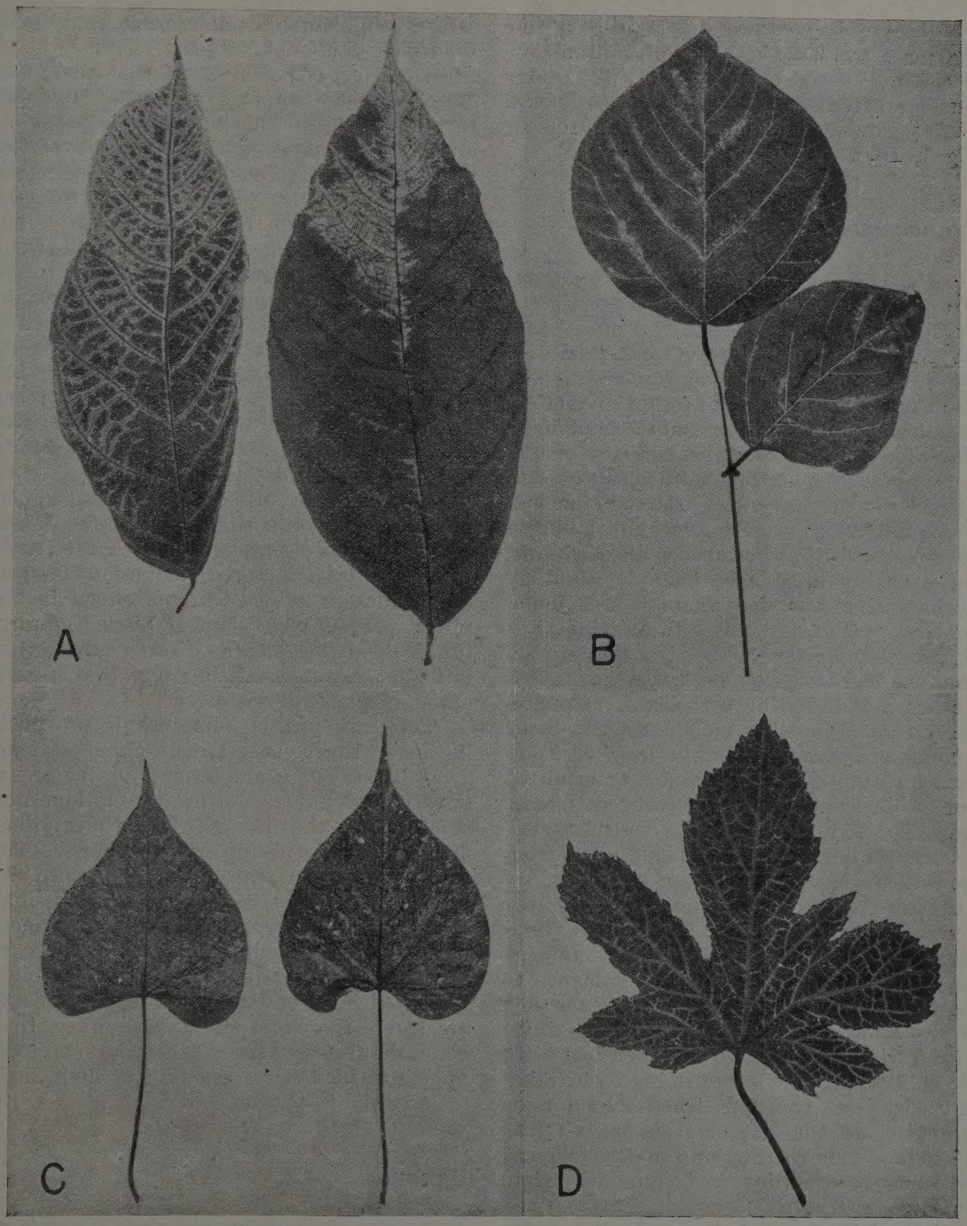

Fig. 1. *Symptoms of virus diseases of cacao, dadap* (Erythrina lithosperma), *sweet potato and okra* (Hibiscus esculentus).

A. *Cacao leaves showing vein-banding.*
B. *Dadap leaves showing vein-banding.*
C. *Sweet potato leaves infected by mosaic.*
D. *Okra leaf infected by yellow vein mosaic.*

this disease is confined to Malvaceae, no evidence is available in Ceylon of transmission to or from weeds belonging to this family. The characteristic symptom is the conspicuous yellow vein-banding of the foliage (Fig. 1, D).

Solanaceous Plants

Leaf curl of chilli (*Capsicum annuum*) is exceedingly common and causes great damage throughout Ceylon. A few years ago chilli was an important and profitable crop in the Jaffna Peninsula but as this disease has reduced the yields by approximately 75 percent the growers are now abandoning the crop. The disease appears to be caused by a virus complex and mite injury. Two distinct mottles have been isolated from the complex by sap transfers. One mottle, proved to be caused by the tobacco mosaic virus, was probably introduced into the chilli by mechanical means, for where it was found the chilli was growing close to mosaic infected tobacco. However, sap transfer studies from the leaf curl complex have shown that tobacco mosaic in the complex is comparatively rare. The other mottle appears to be a common constituent of the leaf curl complex. This mottle is not so readily transmitted from chilli to chilli as is the tobacco mosaic virus. Dr. H.E. Fernando has recently isolated a similar mottle-producing virus from the leaf curl complex by means of aphids. By means of the white fly he has also separated a virus from the complex that causes vein-clearing in chilli. The symptoms induced by this latter virus bear no resemblance to the two separated from the original complex by sap transfers. However, the aphid transmitted virus appears to be identical with the chilli virus that is transmitted with difficulty by sap transfers. The characteristic symptoms of the leaf curl disease of chilli are foliage vein-clearing and mottle followed by pronounced curling, leaf shape distortion, and size restriction.

Storey's leaf-curl and mosaic of tobacco are widespread and disastrous in Ceylon in those areas where tobacco has been grown over a long period. Of the two diseases leaf curl is by far the more important. The losses are particularly high in the variety Harrison's Special, which is unfortunate, since there is a strong demand for the leaf of this variety. A coarse leaf type often referred to as the Jaffna variety appears somewhat tolerant to both diseases. This tolerance is probably due to the long-established practice of the growers in the Jaffna Peninsula of selecting the most attractive plant each year for seed purposes. Although both diseases are widespread in the Jaffna Peninsula, a wind-swept area in the southern part was found to be free. The possibility of protecting newly-established tobacco areas from both diseases is extremely promising. On the Hingeragoda Station in the central part of Ceylon 150 acres of tobacco carried less than 0.1 percent infected plants at the time the leaf was harvested. Tobacco has been grown for only three years on this station.

Little leaf of brinjal or eggplant (*Solanum melongenum*) is widespread in the Jaffna Peninsula and elsewhere. The characteristic symptom is a marked reduction of leaf size, almost a witches' broom effect, in the upper part of the plants. Little information is available on this disease except that it is not sap-transmissible and that it seriously affects fruit yields.

Top leaf curl of tomatoes is prevalent in the wet south central mountainous regions. The disease is characterized by chlorosis, growth restriction, downward curling, and twisting of the leaves. These symptoms first appear at the top of the plants. The disease has been transmitted by white fly, by inarching, and is not sap-transmissible. It appears to have an unusually long incubation period. Symptoms rarely appear in less than 20 days at 80° F. after inarching. In the vicinity of Peradeniya tomato plants are rarely free from the disease when they reach the fruiting stage. When the symptoms appear in plants less than a foot high, little or no fruit is produced.

Banana

Among the well-known virus diseases of Ceylon, bunchy top of plantain (*Musa sapientum*) continues to cause substantial losses, although a compulsory eradication policy established a number of years ago did much to lower the incidence of the

disease. Failure of many growers to search for and destroy diseased plants during the last two years has resulted in a considerable spread. Field evidence suggests that the spread of the disease is due principally to the planting of infected shoots rather than to transmission by aphids. Spread by aphids appears to be very limited.

Tea

The vector of phloem necrosis of tea remains unknown and the disease has not become a serious menace to the industry. It appears to be confined to high elevations and no records exist of the disease being found below 3,000 feet. In addition to this effect of altitude, the distribution pattern is difficult to explain. There is a tendency for the disease to spread to adjacent plants only, as though a soil organism were a vector.

Cucurbitaceous Plants

Cucumber mosaic is by no means rare in cucumber, pumpkin or squash, but the disease is not general throughout Ceylon, and has not become a serious menace to the production of cucurbit fruit except in very limited locations.

Weeds

Few of the virus diseases of the weeds of Ceylon have been investigated. Conspicuous vein-banding diseases of *Stachytarpheta jamaicensis*, *Sida acuta* and *Ageratum conyzoides* are present in all areas where these common weeds are found. All three have been transmitted by inarching or grafting, but sap inoculations failed. A virus disease of *Synedrella nodiflora* characterized by leaf-cupping, chlorosis, and a harshness of the foliage was also transmitted by inarching, but not by sap inoculations.

The Wheat Leaf Miner, *Syringopais temperatella*, in Jordan

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SYRINGOPAIS temperatella Led., the wheat leaf miner or Elachistid moth, known locally as Ed-Dudeh, is a major pest of wheat and to a lesser extent of barley in the Middle East. It may also attack other plants. This important pest has been known to local farmers in Jordan for many decades, and also occurs in Syria, Cyprus, Turkey, Israel and Iraq. Before 1937 no scientific study of this pest had been made in any of these countries. Cyprus is credited with the first efforts toward the investigation of its life history and control, recommending, among other things, grazing of infested fields by sheep with three years rotation. Toward the end of 1937 the former Department of Agriculture of Palestine started a study of this pest under the direction of the author.

Economic Importance

The larvae of the *Syringopais temperatella* mine into the leaves of wheat, feeding on cells and internal tissues of the blades leaving the epidermis transparent. They usually enter the leaf from the tip and work downward towards the base. In heavily infested fields as many as twenty larvae may be found in a single leaf blade. These larvae usually leave old infested leaf blades in search for new ones. Infested leaves turn light brown in color and are very conspicuous during dry seasons. The pest may cause a total loss of the crop especially in wheat fields on poor soil during dry winters. On the average it is estimated that losses caused by the larvae vary from 30 to 100 percent in individual fields and the total annual loss caused to wheat in Jordan amounts to 15 to 20 percent.

Life History, Description and Habits

The adult moth is of light brown color and very small, with a wing span of from 13 to 14 mm. The abdomen of the male is dark steel grey, and of the female yellowish, especially when they approach maturation.

The moths appear in the wheat fields during the first part of April, becoming very numerous and conspicuous toward the second half of the month. The earliest date of their occurrence recorded in Jordan was 25 March. The moths start laying eggs five to seven days after emergence, continue laying for ten days, and then die. Each moth is capable of laying from 100 to 200 eggs, either singly or in small batches on the wheat blades.

Egg-laying commences early in April and reaches its maximum by the end of April. The eggs are lemon yellow in color with dentations on the surface, measuring approximately ½ mm. in length and ⅓ mm. in width.

The eggs commence to hatch in 5 to 7 days. The newly-hatched light yellow larvae were not observed to feed on wheat but to descend immediately from the plants into the soil, where they build webby aestivation cocoons. The cocoons are perfectly round, about ⅓ mm. in diameter, with the larvae curled up inside and barely visible. The web or the outside covering is greyish white.

To ascertain the depth of aestivation, many soil samples of equal volume were collected from different depths at various localities in the Jerusalem District and at Bab El-Wad, and were treated before examination in a special water-air agitation apparatus to free the aestivating larvae

from adhering soil particles. All debris washed from the soil was examined microscopically. From the results, summarized in Table 1, it will be seen that the main concentration of aestivating cysts lies between depths of from 13 to 25 cm. This is of practical importance when deep plowing is recommended as a control measure.

Table 1. – *Distribution of a stivating larvae of Syringopais temperatella at different depths of infested soil in the Jerusalem District and Bab El-Wad*

Soil depth, in cm.	Distribution of larvae, in number	
	Jerusalem [1]	Bab El-Wad [2]
1–6	0	0
7–12	12	30
13–16	71	114
17–20	130	192
21–25	42	175
26–30	9	50
31–35	0	0

[1] Based upon seven samples taken from reddish loamy clay soil.

[2] Based upon fifteen samples taken from brownish loamy soil.

About the beginning of the following January the larvae emerge from the soil to attack the young wheat leaves. The mining of the larvae is not conspicuous at first but becomes so during February and March, and is evident a little earlier on the plains than in the hills.

The larvae pass through six instars before becoming fully grown. As they grow, they become darker in color, turning from lemon yellow to light brown and then to mahogany brown. The average lengths of the larvae are 1.32 mm., 1.53 mm., 2.16 mm., 4.67 mm., 6.00 mm., and 7.33 mm. at the six instars respectively.

At the close of the last instar the larvae go down into the soil to a depth of from 2 to 3 cm., and construct cocoons by cementing soil particles with silken threads. Pupation takes place about the beginning of March, and after two weeks or less, the adults emerge from the cocoons as moths to resume the life cycle.

Control Measures

The leaf miner can be readily controlled by the farmers, if proper methods of cultivation are adopted. Land bearing a crop which has been affected with this pest should be plowed deeply immediately after harvest and no wheat should be planted on that area for at least two years. Wheat should only be grown in rotation with summer crops of durra, sesame or vegetables followed by oats, kersenneh (a variety of vetch) or other legumes. The soil should invariably be deeply plowed to a depth varying from 30 to 35 cm. after the wheat harvest. These methods, which were practised by the former Department of Agriculture, Palestine, on demonstration fields, resulted in complete control of the pest.

Plant Disease Situation in the United States

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Virus Yellows of Table Beets in the Pacific Northwest

TABLE beet (*Beta vulgaris*) seed production has been an agricultural specialty in the Skagit Valley of northwestern Washington for nearly half a century. As early as 1940 a disease which causes yellowing and foliar necrosis was observed in this area, but only recently was it shown to be caused by a virus. Nutritional deficiencies were considered previously as a possible cause. A similar yellowing has been recognized in Europe for many years as "virus yellows", a serious disease of sugar beets, red beets, and forage beets (mangel wurzel). Recently the similarity between virus yellows of Europe and a yellows disease of sugar and table beets now widespread in the United States has been demonstrated. Virus yellows is distinct from mosaic, reported as severe in seed beets in the Puget Sound region of Washington.

The two-year cycle of beets grown for seed and the methods of culture used in this area have tended to increase the severity of virus yellows. Seed is sown in beds during June. In late fall the roots are taken up and placed in pit storage for the winter. The following spring they are transplanted to seed rows, and during August and September seed is harvested. Seed is produced by farmers for seed contractors who supply stock seed, from which the farmers grow the roots (stecklings), or supply the stecklings themselves.

On stecklings transplanted for seed production in March or April, symptoms of virus yellows are not clearly distinguishable until June or July. The first noticeable symptoms are expressed in older leaves of infected plants, which become chlorotic, notably thickened, leathery in texture, and brittle. Symptoms are not apparent in young leaves at first and no foliar patterns or pronounced vein clearing has been observed. Infected seed plants often develop excessive anthocyanin pigment. Chlorotic leaves become orange-yellow to bronze with conspicuous interveinal reddish spots which enlarge, often coalesce, and become necrotic. Chlorosis and necrosis progress until in the final stage, about the time seed plants are maturing, the plant shows a general decline and has abnormally red or yellow, often necrotic, foliage. Affected seed plants have poor root growth and are easily uprooted in a moderate wind. Seed from infected plants is smaller and has less vitality than seed from uninfected plants.

Mangel (*Beta vulgaris* var. *macrorhiza*), sugar beet, and chard (*B. Vulgaris* var. *cicla*), as well as table beet, are affected and characteristically develop similar symptoms such as yellowing of leaf blades, especially at the tips, and thickening and brittleness of the leaf tissues. Infected spinach (*Spinacia oleracea*) seed plants are yellow and stunted. Susceptible weed hosts have not been investigated in the Pacific Northwest, although various chenopodiaceous hosts have been reported for the virus.

Typical symptoms are not expressed in the greenhouse under conditions of low light intensity and unfavorable growing conditions such as prevail during the winter. Even under ideal conditions during summer, inoculated plants in the greenhouse frequently show only yellowed outer leaves which become wilted instead of brittle.

Transmission of the yellows virus is readily obtained with the green peach aphid, *Myzus persicae* (Sulz.). Although in the Pacific Northwest this vector is seldom present in great numbers either in root beds or in seed fields, it is believed to be of primary importance in the transmission of the virus. The virus persists in the aphid

for an indefinite period. Neither the black bean aphid (*Aphis fabae* Scop.) nor the beet root aphid (*Prociphilus betae* Doane) is considered an important vector, but the latter has not been adequately tested. The black bean aphid is the most common insect in beet seed fields.

Most European investigators have not regarded mechanical inoculation as a serious factor in transmission of the yellows virus. Although mechanical transmission is possible under experimental conditions, cultural practices in handling beet roots, planting, and cultivation are not thought to account for the presence or distribution of the disease in seed fields. No evidence of seed transmission in table beet seed has been observed during investigations of the disease in northwestern Washington.

Cultural methods followed in the Puget Sound section for production of beet, mangel and Swiss chard have been ideal for perpetuation of virus yellows. Root beds have been planted indiscriminately in relation to maturing seed fields and often adjacent to them. Aphid migration from seed fields to root beds has resulted in very widespread infection of seedling plants. Biennial seed plants such as beet, mangel, and Swiss chard frequently have shown 100 percent infection. The concentration of these seed fields in the Skagit Valley perpetuates the source of virus.

Beet mosaic, which was formerly regarded as the most important disease in beet seed fields in the Puget Sound section, has been successfully controlled by isolating root beds in areas distantly removed from diseased seed fields. Isolation of root beds alone, however, is inadequate for control of beet virus yellows, probably because of the persistence of the virus in aphid vectors and the widespread culture of biennial seed crops. It is essential that aphids be controlled in isolated root beds and during the early stages of growth in seed fields. Several years' testing of DDT, BHC, parathion, malathion, Metacide, and Systox[1] for controlling the vectors in root beds in the vicinity of infected seed plants failed to give complete control. Only Systox, a systemic insecticide, gave appreciable control on beet stecklings grown in the general vicinity of the seed-producing area. In root beds isolated from the seed-producing area, fair to good control has resulted with all insecticides used, the effectiveness depending largely on the frequency and thoroughness of applications.

At present, virus yellows is the most important disease of beet seed plants in the Puget Sound section, where it apparently has been present for many years. Records since 1940 show that virus yellows has existed along with mosaic but has not been distinguished therefrom.

Virus yellows is also reported from Michigan, Colorado, Utah, Oregon, and California. Apparently it is most severe in the Puget Sound section, probably because of the concentration of susceptible vegetable seed plants. In Europe several related viruses which cause a multiplicity of symptoms in beets have been described. This multiplicity has caused European workers to refer to "mild" yellows and "severe" yellows. European workers who have observed yellows in the United States have concluded that only the mild yellows type is present.

The biennial cycle of the various vegetable seed crops grown in the Puget Sound region necessitates the strict adoption of certain cultural practices if virus disorders are to be avoided. Either aphid vectors must be effectively controlled in root beds grown in the vicinity of seed crops, or steckling plants must be grown in areas free from viruliferous aphids. It has not been possible to control aphid vectors sufficiently to prevent widespread virus infections in the seed-producing area, probably because of the migration of viruliferous aphids from home gardens, weed suscepts, volunteer beet plants, and infected seed crops. Consequently, it has been necessary to grow stecklings in sections well isolated from seed fields and to control migratory aphids. It has become increasingly difficult to locate isolated areas where susceptible seed crops have not been grown and where the virus is not present. Only complete co-operation of all seed growers and contractors to enable the isolation of steckling plant beds, along with aphid control, can control virus yellows.

[1] Systox has not been approved for use on any food crop, to date, and it is not recommended for use on steckling beds.

"Take-All" Disease of Wheat in Illinois

A destructive disease of wheat discovered in 1919 in Madison County, Illinois, was tentatively called "take-all", but later it was shown to be distinctly different. The take-all fungus was not involved and the disease was finally found to be one of the mosaic diseases of wheat, caused by a virus.

From time to time over a number of years, diseased plants from spots in fields of wheat and rye in Illinois have shown characteristic symptoms of take-all, namely: premature dying of the plants, blackened crowns, and black, mycelial plates inside the basal sheaths of diseased culms, but no perithecia of the fungus were found. Reports of occurrence of the disease in Illinois have not mentioned the perithecial stage as having been found there.

In late June, 1952, diseased spots in fields of Royal wheat were examined near Hutsonville, Illinois. Although the wheat had just been harvested, the spots could readily be located by the abundant growth of weeds in them. Mature perithecia of the take-all fungus, *Gaeumannomyces graminis* (Sacc.) Arx & Oliver (= *Ophiobolus graminis* Sacc.), were found at the bases of stubble specimens.

Soybean Diseases in Mississippi in 1951-52

Presley [2] lists 12 parasitic diseases as occurring on soybeans in Mississippi. Observations in 1951 and 1952 revealed several diseases not previously recorded, despite the fact that both seasons were dry and unfavorable for the development of foliar diseases.

Bacterial foliar diseases were the most prevalent of all soybean diseases every year. Bacterial pustule caused by *Xanthomonas phaseoli* was present in virtually every field examined. Bacterial blight (*Pseudomonas glycinea*) was found in some fields but was less severe than bacterial pustule. Wildfire (*Pseudomonas tabaci*) was found in 1951 but not in 1952.

Downy mildew caused by *Peronospora manshurica* was prevalent during both years. In 1951, no incrusted seeds were found; in 1952, however, several strains of soybeans which had shown very little leaf infection had incrusted seeds. Two types of leaf lesions were found on some strains; one characterized by small, pinpoint infections, the other by lesions varying from ½ to 1 cm. in diameter. It appears that two races of *P. manshurica* may occur in this area.

A leaf spot caused by *Phyllosticta* sp. was prevalent during the early part of the 1951 season but was inconspicuous in 1952. Target spot (*Corynespora cassiicola*) was found in some fields in 1951, but it also was scarce in 1952. This disease appears late in the growing season but may cause premature defoliation if prevalent. Varietal and strain differences in susceptibility are evident, and breeding for resistance to target spot should be possible. A leaf spot caused by *Alternaria* sp. was found in both years, but never in amounts sufficient to cause appreciable damage. Frog-eye leaf spot caused by *Cercospora sojina* was present in a few fields in 1951 and was found occasionally in 1952. It was not a serious disease in either year.

Late in the growing season of both years, a leaf, stem and pod spotting was noted and a *Cercospora* sp. was isolated frequently from the lesions. The leaf spots varied from pinpoint size to approximately 5 mm. in diameter and coalesced to cover large areas in some instances. They were reddish-brown with gray centers and frequently were abundant enough to give the entire leaf a dull, rusty appearance. The disease caused premature defoliation of some varieties during both years. The spots on the stems were oval to elongate, ranging from 2 to 30 mm. in length and from 1 to 5 mm. in width. They frequently coalesced to form large discolored areas that were reddish-brown in early stages but later changed to different shades of gray or black. The spots on pods were discrete and varied from pinpoint size to 2 mm. in diameter. They appeared somewhat similar to those caused by *Corynespora cassiicola*. This spotting seems to be correlated with maturity of the host plant.

Other diseases found during both years were: pod and stem blight caused by *Diaporthe*

[2] Presley, J. T. "A host index of Mississippi plant diseases." *Plant Dis. Reptr. Suppl.* 169. 1947.

phaseolorum var. *sojae*, charcoal rot caused by *Sclerotium bataticola*, southern blight caused by *Sclerotium rolfsii*, purple seed stain caused by *Cercospora kikuchii*, and anthracnose caused by *Colletotrichum* spp. Root diseases were observed less frequently than diseases of aerial parts of the plant, except for the widespread occurrence of charcoal rot on the roots of plants nearing maturity and in spots subject to severe drouth.

Soybean mosaic (*Soja* virus 1) was observed each year, and yellow bean mosaic (*Phaseolus* virus 2) was observed for the first time in 1952. The incidence of each was low and at present virus diseases do not appear to be a factor in soybean production in Mississippi.

The following soybean diseases, which were not previously reported from Mississippi, were observed in 1951 or 1952: *Phyllosticta* leaf spot, target spot, *Alternaria* leaf spot, anthracnose, purple seed stain, and yellow bean mosaic.

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Some diseases of economic plants in Bihar, India - II

FROM PREVIOUS ISSUES

Outbreaks and New Records

Canada

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The following records of occurrence or establishment of insects new to Canada were made in 1952, and in all cases the insects were believed to be new to North America as well.

Fruit-infesting Tortricid

The tortricid *Cacoecia oporana* (L.) was reared from larvae found feeding on snowberry (*Symphoricarpus* sp.) at Vancouver, British Columbia. The insect had not previously been found established on any food plant in North America, although a single male had been taken at light in Vancouver in 1937, and in 1950 two specimens had been taken on imported horsechestnut (*Aesculus hippocastanum*) in a nursery in Toronto, Ontario. It feeds on a wide range of plants, notably apple, pear, plum, quince, cherry, blackberry, and walnut.

Flea Beetle on Rape

Larvae and pupae of the flea beetle *Psylliodes chrysocephala* (L.) were collected on rape (*Brassica napus*) on a farm at Topsail, near St. John's, Newfoundland. The species is a pest of cruciferous crops, especially rape and cauliflower. The adults feed on the seed leaves of the young plants, and the larvae tunnel in the stems of the plants and midribs of the leaves.

Weevil in Flooring

The wood-infesting weevil *Pentarthrum huttoni* Woll. was recorded from specimens that had been found in flooring in Quebec City, Quebec, in 1934. The insect occurs most commonly in flooring, but in Europe has been found also in the wood of chests and casks, and in one instance in the undecayed portion of a cherry tree when it was sawn into lumber.

Leafhopper on Cherry

The leafhopper *Erythroneura flammigera* (Geoffr.) was reported from several specimens that had been taken on cultivated cherry in Vancouver, British Columbia, in 1950. The insect is known to feed on a variety of shrubs and trees. A closely related species, *Scaphoideus luteolus*, is a vector of phloem necrosis of elm.

Leafhopper on Loganberry

Another leafhopper, *Macropsis fuscula* (Zett.), was collected in considerable numbers on loganberry (*Rubus loganobaccus*) on Lulu Island, British Columbia. Raspberry growing nearby was not affected. This insect commonly feeds on wild and cultivated species of *Rubus*. Another species of the genus, *M. trimaculata*(Fitch), is a vector of the peach yellows virus.

Introduced Grasshopper Species

Several specimens of the grasshopper *Roeseliana roeselii* (Hag.) were collected at Ville Saint-Laurent and Montreal, Quebec. The species is believed to have been brought to America from Europe by aircraft as the specimens were collected near Montreal airports.

Tortricid on Shrubs and Vegetables

The tortricid *Cnephasia virgaureana* Tr., a pest of shrubs, vegetables, and other low plants, was recorded from St. John's, New-

foundland. This is the first known occurrence since 1916, when the species was collected in this area and erroneously named *Tortrix oleraceana* Gibson. The record suggests that the insect has been established in the province.

United States

Bureau of Entomology and Plant Quarantine,
United States Department of Agriculture,
Washington, D. C.

European Corn Borer Found in Wyoming

European corn borer (*Pyrausta nubilalis (Hbn.)*) was found for the first time in the State of Wyoming, in the summer of 1953, during a survey for this pest in the Western United States. Light infestations were discovered in Goshen, Crook and Platte Counties in Wyoming. The insect was also taken in Adams County, Colorado; however, it had been found previously in this State in 1950.

Spread of Southwestern Corn Borer in Missouri

Delimiting surveys for southwestern corn borer (*Diatraea grandiosella* Dyar) in southwestern Missouri have extended the known distribution of the insect to ten counties in that State. Stalk infestations ranged from very light to as high as 20 percent. Southwestern corn borer was first recorded in Missouri in 1950. In the United States it is now known to be in the States of Nebraska, Kansas, Missouri, Arkansas, Oklahoma, Texas, New Mexico, Arizona and Colorado.

Survey of Cotton Stem Moth

Surveys in the Eastern States for the cotton stem moth (*Platyedra vilella* Zell.), which was first discovered in the United States at Mineola, Long Island, New York, in 1951, were conducted during the summer of 1953. This work resulted in the finding of cotton stem moth larvae in only three States: Connecticut, Massachusetts, and New York. Infestations in the latter State were all on Long Island but widespread over that area. Collections were made at Branford and New Britain, Connecticut, and at Brockton and Manchester, Massachusetts.

PLANT QUARANTINE ANNOUNCEMENTS

Honduras

Decree No. 115 governing the importation of plant propagating materials was published in *La Gaceta*, No. 15078, 25 August 1953, and came into force on the same date. Under its provisions, it is prohibited to import plants, seeds and any other propagating material, including the containers or soil for their packing, unless, in addition to the authorization of the Ministry of Agriculture, the following documents are presented at the customs upon their arrival:

(*a*) a sanitary certificate issued by the Ministry of Agriculture of the exporting country or the office designated by that Ministry;
(*b*) a certificate affirming freedom from virulent pests in the area of origin; and, if possible;
(*c*) a certificate stating that the articles have been passed through the cyanogen tent at the shipping port.

Even if the above requirements have been complied with, the Ministry of Agriculture of Honduras may place in quarantine the plants and materials referred to in this decree, for the time considered necessary to verify their sanitary condition. On failure to comply with these dispositions, the Ministry of Agriculture will confiscate the articles and impose corresponding fines.

Mauritius

Importation of the Tomato Plant (Prohibition) Proclamation, dated 14 August 1953, prohibits the importation into Mauritius from Reunion and Madagascar of the tomato plant and of all parts of such plant, except seeds, on account of the presence of the Trypetid fruit fly, *Pardalapsis cyanescens* Bezzi, in Reunion and Madagascar.

Trinidad and Tobago

Plant Protection Regulations of 10 February 1953 (Government Notice No. 42) replace the *Plant Protection Regulations* of 25 August 1941. The changes introduced consist mainly of the addition or removal from the specific schedules of a few materials, the removal of restrictions on imports by aeroplane, and the requirement of a permit for the importation of certain cotton products and broom corn. The main provisions of the present regulations are as follows.

Planting material. Planting material specified below shall not be imported unless a permit prescribing conditions of entry has been obtained for each consignment:

Sugar cane including seed, and seed (except cereals) and other parts of all other members of Gramineae.
Coffee.
Banana, plantain and all members of the genus *Musa*.
Cotton.
Citrus and all members of the tribe Citrinae.
Cacao and all members of the genus *Theobroma*.
Hevea.
Grapes.
Coconuts, except coconuts from British West Indies.
All plants growing in or accompanied by soil.

A written application for a permit should be made to the Director of Agriculture and should specify the quantity, kind, value and origin of the material, the name and address of consignee and consignor, and the means of transportation. The permit together with a certificate issued by the plant inspection service of the country of origin, specifying the origin of the material, the number and description of packages and the treatment adopted, and certifying freedom from harmful agents, should be delivered to the customs officer at the port of entry. The importation of consignments originating in a country without a plant inspection service shall be subject to the conditions imposed by the Director of Agriculture.

Fruit and vegetables. Fruit not for planting purposes may be imported only from the United Kingdom, the Republic of Ireland, Canada, the United States, New Zealand, Tasmania, and the British West Indies. Provided that:

(*a*) Plantains may be imported from any source.
(*b*) Banana fruit may be imported only from the British West Indies.
(*c*) Citrus fruit may be imported only from the British West Indies, but excluding the British Virgin Islands.
(*d*) Pineapples may be imported from British Guiana in addition to the territories enumerated above.

Fruit from other sources may not be imported except under a permit granted by the Director of Agriculture on production of satisfactory evidence that such fruit is free from disease or pest.

Vegetables which may be imported from Bermuda are restricted to potatoes, beetroots, carrots, turnips, cabbages, celery and onions. Vegetables from the mainland of America south of the United States may be imported only under permit.

Fruit and vegetables from the British West Indies and vegetables from Bermuda must be accompanied by a certificate issued by the plant inspection service of the country of origin stating that they have been examined at the port of shipment and that they and their containers are reasonably free from trash and soil.

Cotton and cotton products. Cotton seed and seed cotton shall not be imported without a permit and shall be subject to the conditions prescribed for planting material.

Cotton lint, cotton linters, cotton seed meal or cotton seed cake are not admissible except under permit granted by the Director of Agriculture, who may determine the conditions for such importations. Manufactured cotton goods, prepared cotton wool or other processed cotton are exempted from this restriction.

Used bags, sacks, bailing material or other containers which have contained cotton are prohibited entry.

Allspice, bay and related plants. The fruit and other parts of allspice (*Pimento officinalis*), bay tree (*P. acris*) and all other plants of the genus *Pimento* may not be imported from any island of the Greater Antilles.

Soil and dung. Soil and dung, except dung in a container of an imported animal, are prohibited importation. A special permit must be obtained for importing such material for scientific investigations.

Plants and plant products not for planting. The following plants or parts thereof shall not be imported if not for planting purposes:

Sugar cane and all other members of Gramineae, except cereals.
Coffee, with the exception of roasted coffee, and coffee for transhipment. If raw coffee arrives by sea for transhipment, neither the coffee nor the packages shall be brought ashore.
Citrus and all plants of the tribe Citrinae, except citrus fruit.
Cacao and all plants of the genus *Theobroma*. Cured cocoa beans are prohibited importation from the American continent south of the Panama Canal except from Venezuela and Colombia.
Coconut except dry, husked nuts, corn, copra and processed coconut fibre.
Cotton.

Broom corn (i.e., dried inflorescences and attached stems of sorghums) may be imported with the Director of Agriculture's permission, subject to inspection and subsequent treatment.

Hay for the use of animals may be imported unless prohibited by the Diseases of Animals Ordinance.

Plant packing material. Straw and other unprocessed plant material originating in temperate countries and in normal commercial use as packing material is admissible unless prohibited by the Disease of Animals Ordinance.

Transhipment of plant material. Transhipment of plant material brought to Trinidad and Tobago by aeroplane shall be allowed only if a permit has been obtained in advance.

General regulations. Any plants, soil, dung, living insect, non-marine invertebrate animal or any accompanying packages may be imported only through the port of Port-of-Spain or the Piarco Airport, unless a permit has been granted by the Director of Agriculture authorizing entry through any other port. Any such articles shall be examined before delivery by a plant protection officer who may subject it to any treatment deemed necessary. The undermentioned articles, however, shall be exempted from these restrictions:

(*a*) Seeds of vegetables or ornamental plants from commercial seedsmen in the United Kingdom, the Republic of Ireland, Canada and the United States.
(*b*) Dry, hulled rice.
(*c*) Cereal grains not for propagation.
(*d*) Pulses.
(*e*) Nuts.
(*f*) Dried, canned, candied, or other processed fruits and vegetables.
(*g*) Roasted coffee.
(*h*) Commercial yeast.
(*i*) Processed plant products which are free from any organism.

Uruguay

A Decree of 30 June 1953, published in the *Diario Oficial*, Vol. 192, No. 13990, 23 July 1953, prohibits the importation of citrus plants and vegetative parts thereof from any place, on account of the danger of introducing virus diseases. Introductions made by the technical officers of the Ministry of Animal Husbandry and Agriculture are excepted from this prohibition.

Viet-Nam

Orders No. 417 – No. 420–Cab–SG–SE of 22 June 1953 concerning plant protection were published in the *Journal Officiel*, No. 44, 22 August 1953 and came into force on 1 July. By these orders, all previous provisions contrary to those contained in the above are abrogated.

Order No. 417 establishes general measures for the phytosanitary inspection of plants or plant products to be exported from Viet-Nam.

Order No. 418 establishes general measures for the phytosanitary inspection of plants or plant products to be imported into Viet-Nam. In the absence of measures provided by a special order, no living plant or part thereof may be imported without a phytosanitary certificate

issued by the competent service of the country of origin, attesting that such plant or part of plant as well as the packing material and accompanying soil or composts are free from diseases and pests. Importers should submit to the plant protection service a declaration of importation on a prescribed form and inspection will be carried out within the following 24 hours. Infested material wil be treated according to the inspector's decision.

Order No. 419 establishes the means of collecting taxes for phytosanitary operations.

Order No. 420 establishes the ports open for the export and import of plants and plant products. As a temporary measure, the following air and maritime ports are authorized:

In north Viet-Nam:	Gia-Lam, Cat-Bi, and Haiphong.
In south Viet-Nam:	Tan-Son-Nhut and Saigon.

NEWS AND NOTES

Latin American Meeting of Coffee Technologists

The Coffee Round-Table Meeting was held in San José, Costa Rica, 21-26 September 1953, under the auspices of the Costa Rican Ministry of Agriculture and Industry, in co-operation with FAO, the Inter-American Institute of Agricultural Sciences, and the Central American, Mexican and Caribbean Association of Coffee Growers and Producers. It was attended by 33 coffee scientists representing 19 different organizations and a number of observers. In addition to the presentation of papers of scientific or general interest, four working committees were organized to facilitate discussions. These committees dealt with the following subjects respectively: (1) establishment of an organization to solve problems in common; (2) coffee protection; (3) coffee genetics and breeding; and (4) general problems.

The five-day session resulted in a series of recommendations, which, if acted upon by the interested countries and institutions, will undoubtedly bring about the desired co-ordination of scientific efforts in regard to coffee improvement which has been long overdue. Briefly, the main recommendations are as follows:

1. An autonomous center for interchange of coffee technology, known as the *Centro de Intercambio Tecnico Cafetalero*, is to be organized within the administrative set-up of the Inter-American Institute of Agricultural Sciences and will carry out educational and extension campaigns, issue popular and scientific publications, and undertake the compilation of coffee bibliography. It will also be empowered to deal with emergencies, in cases such as any incidental introduction of coffee rust into America, or appearance of any new disease or plague.

2. An Association of Coffee Technologists is to be formed, along the lines of the Internationai Association of Sugar Cane Technologists, with meetings held every five years.

3. Recognizing the danger of introducing coffee diseases and pests, the governments in the New World are urged to adhere to the International Plant Protection Convention of 1951 and to observe particularly its provisions applicable to the prevention of the spread of pests and diseases.

4. The coffee-producing countries in the Western Hemisphere are requested to take advantage of the quarantine facilities established by the U. S. Department of Agriculture at Coconut Grove, Florida, and not to introduce coffee propagating material directly from the Orient, unless the country possesses adequate quarantine controls, or unless the material has been certified as free from pests and diseases by the U. S. Department of Agriculture.

5. In view of the inadequacy of knowledge at hand, it was recommended that disease and pest surveys be made in every coffee-growing country, and be followed by studies of their biology, thus leading to effective control.

6. Coffee-planting material for research is to be sent first to five centers in tropical America, i. e., Brazil, Costa Rica, El Salvador, Colombia and Puerto Rico, for screening and testing before distribution to other countries for breeding purposes. The five centers will divide the responsibility with respect to testing reactions of different coffee species and varieties to diseases and pests.

The reports of the meeting were published in Spanish in two volumes and may be obtained through the Ministry of Agriculture and Industry, San José, Costa Rica.

Roma - Tip. del Senato del dott. Giovanni Bardi

CEREAL BREEDING PROCEDURES

This FAO Development Paper covers the whole field from the hybridization of the parent plants until a new variety is in commercial production. Methods of growing hybrid populations, systems of testing and recording of results, variety purification and increase of pure seed, as well as the analysis of data, are treated in detail. Various types of nurseries are described for the breeding of varieties resistant to plant diseases and insect pests, and tolerant to certain climatic factors such as frost.

Special features of the publication are the sixteen appendices which graphically illustrate planting plans, plot arrangements, the statistical progress of a cross, variety purification and other features of a cereal breeding program. The complexity involved in modern plant breeding methods and the consequent necessity of systematizing the procedures are clearly and impressively indicated, 122 pages, $ 1.25; 6s. 6d.

LEGUMES IN AGRICULTURE

This unique collection of information on legumes, edited by R. O. Whyte, G. Nilsson-Leissner and H. C. Trumble, required the collaboration of specialists in every Member Country of FAO. No fewer than 111 contributors are acknowledged, and contributions from many more are mentioned in the text.

Nowhere else is such information available in one volume and, by pointing to the limitations in the data on economic botany, ecology and the biotic relationships of legumes it is hoped to encourage further research and experiment particularly in tropical and sub-tropical areas. An appendix tabulates the species, indicating plant characteristics, climatic adaptation, soil adaptation, utilization, number of seeds per pound and seeding rates in pounds per acre. 368 pp., many illustrations, $ 3.00; 15s.

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